



THE EFFECTS OF RICE BRAN AS A NITROGEN SOURCE FOR D-LACTIC ACID PRODUCTION ON *ZYMOMONAS MOBILIS*

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Introduction

Lactic acid is used as a raw material for polymerization of Polylactic acid (PLA), which is an important component of biodegradable plastic. We have developed a free D(-)-lactic acid producing *Zymomonas mobilis* by introducing a heterologous D-lactate dehydrogenase (D-ldh) gene from *Leuconostoc mesenteroides*. Currently yeast extract commonly is used as nitrogen source for *Z. mobilis*, however, yeast extract is expensive. This study examines the possibility of using rice bran as nitrogen source. *Z. mobilis* is grown in rice bran and corn steep liquor, and its glucose uptake and lactic acid yield is examined.

Methods

D-ldh gene was inserted into chromosomal DNA of *Z. mobilis* through homologous recombination. Lactic acid fermentation was conducted in a 5L fermentor with a working volume of 2L. The fermentation media had composition of 100g/L glucose, 10g/L of yeast extract, rice bran, or corn steep liquor, 2 g/L KH_2PO_4 , 1 g/L $(\text{NH}_4)_2\text{SO}_4$, and 1 g/L MgSO_4 . The fermentor was maintained at 30°C and pH 5.0 (by addition of 3N NaOH) with agitation rate of 300 rpm for batch culture. The glucose uptake and lactic acid production were analyzed by high-performance liquid chromatography (HPLC) with Shimadzu 20AD series.

Results

When the fermentation was carried out under optimal rice bran powder concentration of 10 g/l, the D-lactic acid yield reached 35% with a volumetric production rate of 1.5 g l⁻¹ h⁻¹. Compare to corn steep liquor and yeast extract, the D-lactic acid yield increased by 9.12% and 7.00%, respectively. In addition, the optical purity of D(-)-lactic acid was extremely high of 99.9% or above in all conditions.

Table 1. Kinetic Parameters of Each Nitrogen Source

	1% yeast extract	1% rice bran	1% corn steep liquor
glucose uptake rate (g/l/h)	4.48	4.20	3.53
Lactic acid yield (g/g)	33.24	35.56	32.59
Lactic acid productivity (g/l/h)	1.48	1.50	1.18
Final time of fermentation(h)	22.5	23.7	27.7

Conclusions

When rice bran was used as nitrogen source, *Z. mobilis* showed higher D-lactic acid yield. While glucose uptake rate was decreased, lactic acid yield increased. This shows that rice bran is an attractive substitute for high priced yeast extract. Future studies should aim to further increase D-lactic acid yield.

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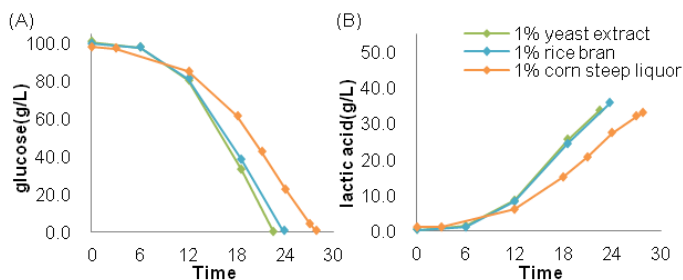


Figure.1 Glucose update and lactic acid yield of each nitrogen source.